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# USSR Report

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13 November 1985

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## METEOROLOGY

### SHIPBOARD COMPLEX PROCESSES INFORMATION FROM WEATHER SATELLITES

Moscow VODNIY TRANSPORT in Russian 25 Jun 85 p 3

[Text] A hardware-software complex developed at the Far East Research Center's Institute of Automation and Control Processes is called upon to aid scientists who are studying the ocean. This complex has automated the processing of information received on scientific research ships from weather satellites.

While intended chiefly for receiving satellite information, the complex performs other tasks, too. For example, it collects readings from many sensing devices deployed in the ocean, freeing specialists for more creative work. In addition to its purely scientific uses, the new system enables navigators quickly to update weather maps and charts of movements of ice fields.

FTD/SNAP

CSO: 1865/401

## GOSKOMGIDROMET PLANS AUTOMATION OF AERIAL CLOUD-SEEDING WORK

Moscow LITERATURNAYA GAZETA in Russian 26 Jun 85 p 11

[Article by DOROFYEVA, VERA and DOROFYEV, Vil']

[Abstract] The full-page article surveys activities of the USSR State Committee on Hydrometeorology and Monitoring of the Natural Environment (Goskomgidromet). Particular attention is devoted to weather forecasting and modification work which the committee and its divisions are doing in support of agriculture, industry, environmental protection and aviation.

Mention is made of a general agreement between Goskomgidromet and Aeroflot regarding the provision of alternative airfields for airliners en route to their destinations. In line with this agreement, authorization for a flight can be granted only on the condition that the airliner is guaranteed two such fields to land on, if necessary. It is noted in this connection that aircraft of Aeroflot landed on alternative airfields 12,218 times in 1983.

I. I. Burtsev, head of Goskomgidromet's Administration for the Employment of Active Modification in the Economy, commented on the development and testing of an original computerized complex for cloud-seeding work aimed at inducing rainfall. This complex was developed by specialists of the committee and engineers. During flights on airplanes equipped with this complex, cloud zones that are optimal for seeding are detected with the aid of suitable apparatus and a computer, which issues the necessary recommendations for the crew. The testing of the complex is scheduled for completion this year. Work is to begin this year on inducing additional rainfall over 500,000 hectares of steppe lands in the Ukraine and over areas of 300,000 hectares in Georgia and 100,000 hectares in Uzbekistan.

The protection of agricultural crops against hail is called the main direction of the administration's weather-modification work. An account is given of a flight in which hail-bearing clouds were seeded by means of rockets fired from a radar-equipped airplane. The equipping of such airplanes with computerized units for processing multiple-contour radar representations (BOMO) reportedly is planned at an early date. In a "radar--computer--BOMO--rocket" system of the future, the operation of the radar set will be automated, and rockets will be fired from the airplane on a command from the computer.

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## OCEANOGRAPHY

### ATLANTIC CRUISE PLANS OF GEOLOGICAL SHIP 'STRAKHOV'

Moscow NEDELYA in Russian 3-9 Jun 85, No 23 p 4

[Article by Batalov, Leonid]

[Excerpt] The coming of the field-work season together with summer has summoned hundreds of scientific teams to travel. Where will these scientists' work take them, and what problems will they study on their expeditions?

Professor Petr Petrovich Timofeyev, corresponding member of the USSR Academy of Sciences, deputy director of the academy's Geology Institute and a USSR State Prize laureate, related: "The 'Akademik Nikolay Strakhov', a scientific research vessel of our institute, will leave on its maiden cruise this year. The technical equipment of this new scientific ship is to be thoroughly checked, and studies are to be made of sedimentary rocks under the Atlantic floor and of the structure of oceanic blocks of the earth's crust. This cruise must furnish answers to many questions pertaining to the geotectonics, lithology and stratigraphy of the floor of the world's oceans."

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CSO: 1865/401

## USSR, GDR OCEANOLOGISTS COMPLETE AEROSPACE STUDIES IN BALTIC

Leningrad LENINGRADSKAYA PRAVDA in Russian 26 Jun 85 p. 4

[Article by S. Krayukhin]

[Excerpt] The third oceanographic experiment in the Baltic Sea with the participation of oceanologists of the USSR and the German Democratic Republic (GDR) has been successfully completed.

A group of researchers of the Leningrad branch of the State Oceanographic Institute were on the Baltic coast, where they received routine scientific information from artificial earth satellites. Apparatus installed on board the satellites made it possible to obtain pictures of the area under study in various parts of the spectrum and to measure the temperature of the sea from a distance of several hundred kilometers.

The "Alexander von Humboldt", a scientific research vessel of the GDR's Institute of Oceanology, took an active part in the experiment. It sailed the international waters of the Baltic over a specially prepared route that closely covered the entire area of the experiment, from Ventspils to Kaliningrad. Soviet oceanologists worked together with their German colleagues on board the vessel. Thanks to the latest instruments and apparatus, the scientists were able to record continuously measurements of the temperature of the sea's surface.

Specially equipped AN-30 and IL-14 airplanes took off from the Vilnyus and Klaypeda airports at the times specified by the program. Researchers observed the condition of the sea's surface, the atmosphere and cloudiness from various altitudes. And aerial photography of the sea's surface was conducted with the aid of multizonal apparatus developed jointly by specialists of our country and the GDR.

Routine control the experiment was effected by a special group located in Klaypeda. The Klaypeda Marine Hydrometeorological Observatory rendered substantial assistance in organizing and conducting the experiment.

Candidate of Physical-Mathematical Sciences S. V. Viktorov, director of the experiment on the Soviet side, held a preliminary discussion of the experiment's results.

"This is the first time that such an actively controlled experiment has been conducted jointly with our colleagues from the GDR," said Sergey Vasilyevich. "The experiment is significant for the further advancement of space oceanography and the practical utilization of satellite information in studying the sea environment. These data can be used for the development of fishing and shipping on the Baltic Sea, and also for meteorological support of an international ferry that is under construction."

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CSO: 1865/407

## BACTERIAL PREPARATION, AEROSOLS FOR CLEANING UP OIL SPILLS

Vilnius SOVETSKAYA LITVA in Russian 21 Jun 85 p 4

[Excerpt] A bacterial preparation which scientists of the West Siberian Scientific Research Institute of Geological Surveying and Petroleum have developed will help to restore the environment when oil spills occur.

In a laboratory of the institute, a TASS correspondent was shown this preparation, which outwardly resembles an ordinary detergent. The only difference is that this powder 'launders' oil slicks. A few dozen grams of the preparation are enough to eliminate, in 24 hours, an oil film covering an area of about a hectare.

There was a sector in Nizhnevartovskiy Rayon in which the pollution level been as high as 15 kilograms of petroleum per square meter. Two months after treatment with the preparation, this sector had regained its original appearance. The same effect has also been obtained on ocean waters; the bacteria destroyed an oil film in full view of the experimenters.

The Soviet specialists have proposed the use also of aerosols to combat oil spills on the sea that are a real economic disaster. In such cases, extremely small spherical particles are sprayed which do not themselves sink or dissolve. Instead, these tiny, hollow plastic or carbon balls become well saturated with the oil.

A ton of oil was gathered together with these sorbents after 20 to 100 kilograms of them had been sprayed by a compressor. They absorb almost all of the oil, leaving only small traces that are easily removed by the sea itself. The particles are gathered mechanically. Removing the oil from them is a fairly simple matter.

FTD/SNAP

CSO: 1865/407

COMPUTERIZED EQUIPMENT OF NEW GEOLOGICAL SHIP 'SIDORENKO'

Moscow SOVETSKAYA ROSSIYA in Russian 9 Jun 85 p 5

[Article by Udachin, Vladimir]

[Abstract] The article reports on the first cruise of the "Akademik Aleksandr Sidorenko", a new research ship of the Southern Marine Geology Association, which is located to Gelendzhik. The ship was built in Nikolayev. An account is given of the first days of the cruise, during which the ship sailed from Gelendzhik and passed through the Bosphorus. P. B. Rozov was the head of this cruise.

Information is provided on new systems of the "Akademik Aleksandr Sidorenko" which were to be tested at great depths in three different seas. Numerous educational and research institutes took part in the development of the systems. The equipment includes a unified computer center which controls geological-surveying processes, receives input from all of the ship's research systems, records and processes all information gathered from the ocean floor by various types of apparatus, and directs studies on the basis of this information. The "Sidorenko" is said to be the first Soviet geological vessel to be equipped with such an extensive complex of apparatus and systems for prospecting mineral resources at great depths.

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# MODEL INTERPRETATION OF ANNUAL VARIATION OF TEMPERATURE FIELDS OF AIR AND WATER BOUNDARY LAYERS OF WORLD OCEAN

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian  
Vol 21, No 5, May 85 (manuscript received 24 Oct 83,  
after revision 13 Jan 84) pp 537-543

ROZHDESTVENSKIY, A. Ye. and SEMENOV, M. V., State Oceanographic Institute

[Abstract] Heat exchange between the ocean and atmosphere is largely determined by the temperatures of the boundary layers of these media, especially the annual variation of temperature of the ocean  $T_w$  and atmosphere  $T_a$ . A study was made of the behavior of the phase difference  $\Delta\varphi$  over the entire area of the world ocean, other than the polar regions, from  $60^\circ\text{N}$  to  $60^\circ\text{S}$ . The  $\Delta\varphi$  value was obtained for each  $10^\circ$  grid square using the mean  $T_w$  and  $T_a$  climatic values. Over almost the entire world ocean the temperature of the near-water atmospheric layer in its annual variation "outruns" ocean surface temperature ( $\Delta\varphi > 0$ ). The average shift for the entire ocean is 7 days (Atlantic -- 8, Indian -- 9 and Pacific -- 5 days). A table gives the  $\Delta\varphi$  values in days averaged for  $10^\circ$  latitude zones for each of the oceans and the world ocean as a whole and the standard deviations from the mean values. The temperature latitudes of the northern hemisphere are most uniform with respect to  $\Delta\varphi$ ; the maximum phase shifts are observed there, but there are individual regions in both the tropical zone and in the Antarctic Ocean with extremal  $\Delta\varphi$  values. In comparison with the northern hemisphere temperate latitudes the tropical latitudes and the Antarctic Ocean have a more complex structure of  $\Delta\varphi$  distribution. Since the overwhelming area of the world ocean is characterized by an annual course of atmospheric temperature with such a phase shift, this "outrunning" cannot be attributed to advective heat transport. This characteristic of the annual variation of temperatures can be explained in a model of thermal interaction between the boundary layers of the ocean and atmosphere. The proposed model differs from those proposed earlier with respect to the method for stipulating heat exchange between the media. Heat budget equations are written for boundary layers of the ocean and atmosphere of a given thickness. The influx of solar radiation, absorption and radiation of thermal energy in each of the media, exchange of apparent and latent heat are taken into account. The main factor responsible for the observed phase difference is the radiative heat inputs in the lower layer of the troposphere. Figures 1; tables 2; references 6: 5 Russian, 1 Western.

[395-5303]

## FORMATION OF STRUCTURE OF MIXED REGION UNDER INFLUENCE OF SHEAR FLOW IN STRATIFIED FLUID

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 21, No 5, May 85 (manuscript received 21 Mar 84, after revision 4 Sep 84) pp 528-536

DYKHNO, L. A., Oceanology Institute, USSR Academy of Sciences

[Abstract] This is a continuation of the author's earlier work (IZV. AN SSSR, FAO, No 7, pp 622-629, 1984). That involved study of the forms of shear instability manifested in the process of formation of a mixed region under the influence of a shear flow in a stably stratified fluid. It was found that the process of entrainment of the fluid into the mixed region in the transient period from laminar movement of a fluid to turbulent movement is caused by the generation of large-scale eddies in the flow as a result of development of different forms of shear instability. The findings reflected the mechanism of generation of turbulence in a shear flow with a nonlinear distribution of density and velocity with depth. Proceeding on this basis, the author further discusses the forms of shear instability accompanying the formation of the mixed region and at least qualitatively explains a number of processes transpiring in the ocean under the influence of the developing and stationary wind. The experimental apparatus was described in the earlier study. The rectangular flume measured 80 x 16 x 20 cm. Air was fed for creating a velocity shear in the water in a wind channel formed by the flume cover and the free surface of the water. The initial stratification was formed as a result of heat exchange between the cold water and warm air. A stable temperature profile was established in the water with a gradient increasing toward the surface. The initial stratification was evaluated using the temperature gradient in the layer, which was varied from 0.12 to 0.3°C/cm. The following measurements were made: air flow velocity, water flow velocity and vertical temperature profile. A laser "knife" was used in visual observations. A study was made of the main stages in formation of the mixed region. The mechanism of entrainment of fluid by large-scale eddies was explored in depth. This research made it possible to find the dependence of entrainment rate on Richardson number. Figures 5; references 12: 5 Russian, 7 Western. [395-5303]

## COMPUTATION OF OCEAN UPPER LAYER THERMAL STRUCTURE

Moscow OKEANOLOGIYA in Russian Vol 25, No 3, May-Jun 85  
(manuscript received 3 Feb 84) pp 378-385

BENILOV, A. Yu., KOZHELUPOVA, N. G. and FILYUSHKIN, B. N., Oceanology  
Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow

[Abstract] Specialists at the Oceanology Institute have developed a mathematical model which on the basis of meteorological data makes it possible to predict the temperature of the upper quasihomogeneous layer (UQL), its thickness, drift current velocity and characteristics of vertical structure of the temperature field in the upper layer of the ocean governed by heating of the ocean from the surface and the convection arising during cooling. This integral model is intended for prediction of UQL short-period changes occurring against the background of seasonal changes. Two stages in UQL development during the course of the year were regarded as most interesting for experimental checking: stage of spring-summer heating of ocean and stage of autumn-winter cooling. Storm effects during which there can be considerable increases in UQL thickness and formation of a stepped structure of temperature change with depth are superposed on these mean seasonal changes. A full experiment for checking the integral model required a knowledge of the initial conditions in a test region and the values of the determining parameters for the entire period of the prediction for evaluating the agreement between computed and experimental data. On the 35th cruise of the "Akademik Kurchatov" provision was made for prolonged work at a point with simultaneous observations of currents, with profile observations of temperature and salinity, study of the field of internal waves, direct measurements of heat balance components and a full range of meteorological observations. The work was done in the North Atlantic during the period of spring-summer heating and summer. A value obtained in the case of well-developed wind waves was used as the sea surface resistance coefficient. It was found that the integral model makes it possible to compute change in thickness of the UQL and its temperature for 3-4 days in advance with an accuracy acceptable for practical purposes using initial data and current wind velocity and heat flow values at a point. Figures 5; references: 8 Russian.  
[394-5303]

## INVESTIGATION OF CHARACTERISTICS OF SYNOPTIC MOVEMENTS ON SPHERE

Moscow OKEANOLOGIYA in Russian Vol 25, No 3, May-Jun 85  
(manuscript received 25 Aug 83, after revision 2 Apr 84) pp 386-394

MARUSHKEVICH, A. D., Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow

[Abstract] Several numerical experiments were carried out for simulation of movements of a synoptic scale on a sphere: development of movements from a stipulated initial state. The main objective was clarification of the characteristics of movements of a synoptic scale associated with the earth's sphericity (in comparison with the  $\beta$ -plane). The computation region was in the form of a segment of a spherical surface bounded on the north and south by arcs of latitude and on the west and east by meridians. In modeling synoptic eddies consideration was given only the barotropic mode of movements (a vertical uniformity of currents was assumed). Such an approach makes possible considerable simplification of mathematical formulation of the problem while retaining the main physical features of behavior of the barotropic component of movement. The initial equations used were the equations of motion in spherical coordinates in the Boussinesq approximation and in the "traditional" approximation. Two variants of the model were tested: in spherical coordinates and Cartesian ( $\beta$ -plane approximation) coordinates. A study was made of evolution of densely packed systems of eddies and computations were made of the energy components of the synoptic eddy field. The results of computations made with the two variants are analyzed and the differences in the nature of evolution of the eddy field and in change of its energy components for currents on a sphere and on the  $\beta$ -plane are defined. It is concluded that in studies of synoptic movements in the open ocean in regions with a great longitudinal extent (some ten degrees) it is necessary that the earth's sphericity be taken into account since the use of the  $\beta$ -plane approximation in this case gives results differing somewhat in qualitative and quantitative respects. Figures 5; references 14: 110 Russian, 4 Western.  
[394-5303]

## STRUCTURE OF ANTILLES-GUIANA COUNTERCURRENT IN NEIGHBORHOOD OF DEMERARA RISE

Moscow OKEANOLOGIYA in Russian Vol 25, No 3, May-Jun 85  
(manuscript received 4 Aug 82, after revision 28 Apr 83) pp 403-407

DUBROVIN, B. I., Atlantic Scientific Research Institute of Fishing and Oceanography, Kaliningrad

[Abstract] The Antilles-Guiana Countercurrent is formed in the region 35-37°N and 65-67°W, is traced from the surface to a depth of more than

1,000 m and extends almost to 30°W. Oceanographic data available until recently could not give a convincing answer to a number of key questions relating to the sources of formation of the Antilles-Guiana Countercurrent, its structure and interaction with the highly saline waters of the North Atlantic anticyclonic circulation. An expedition on the "Vayda" explored the region of the Demerara Rise (2-8°N, 40-45°W) in accordance with the USSR-Cuban agreement on study of fishing areas. The objective was study of the dynamic structure of waters in the neighborhood of the Demerara Rise. The collected data provided details on structure of westerly boundary currents in this region. Three hydrological runs were made. Currents were measured from shipboard with two series of BPV-2 current meters at the horizons 10, 25, 50, 100, 300, 400, 500, 700, 800, 1,000, 1,100, 1,400 and 1,500 m. The instruments were held at each horizon for 30-60 minutes, giving 6-12 measurements at 5-minute intervals, after which they were averaged. The final results were represented in the form of the distribution of current velocity normal to the direction of the hydrological runs. An approximate estimate of countercurrent discharge volume is given. A genetic relationship was found between the highly saline waters reaching the equator together with the Antilles-Guiana Countercurrent and the system of equatorial countercurrents. It is concluded that the main source of the Antilles-Guiana Countercurrent is the waters of the Florida and Antilles Currents. Figures 3; references: 10 Russian. [394-5303]

UDC 551.463.5

# VERTICAL STRUCTURE OF TURBULENCE AND TURBULENT EXCHANGE IN EQUATORIAL ZONE OF PACIFIC OCEAN

Moscow OKEANOLOGIYA in Russian Vol 25, No 3, May-Jun 85  
(manuscript received 23 Sep 83, after revision 23 Mar 84) pp 414-419

GEZENTSVEY, A. N., Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow

[Abstract] Experimental study of intermittence, determination of the laws of distribution of the sizes of turbulent zones and the coefficients of vertical turbulent exchange in intermittent turbulent fields are extremely timely because without a knowledge of the laws of these phenomena it is impossible to give an adequate description of the vertical redistribution of heat, salt and momentum in the ocean. On the 24th cruise of the "Dmitriy Mendeleev" complex hydrophysical measurements were made in the equatorial system of currents in a broad range of spatial-temporal scales in a test range situated in the limits 163°15'-167°W and 2°N-2°S. Fluctuations of the current velocity field were measured by the "Baklan" freely falling probe. Fluctuation measurements were accompanied by registry of depth and mean water temperature. Measurements of velocity fluctuations were made using a sensor of the magnetohydrodynamic type, insensitive to the influence of

medium stratification, with a linear characteristic and an instrument noise level  $\sim 0.07$  cm/sec. Measurements were made in the frequency range 4-64 Hz with a mean rate of submergence of the probe of 1 m/sec, making it possible to register turbulence in the range of vertical scales from 2 to 25 cm. Measurements of small-scale turbulence were accompanied by synchronous background hydrometeorological measurements, including current measurements from aboard a drifting ship with subsequent corrections for drift. At each station a series of 8-10 automatic BPV-] current meters were used with a distance between instruments 10-15 m and with a discreteness of measurements of 5 minutes. They were held at the horizons for 1 hour. Data were processed on shipboard. At these stations in the Southern Trades Current it was possible to trace individual turbulent formations or spots. The histogram of distribution of thicknesses of turbulent spots is approximated by an exponential law with the parameter  $\mu = 0.43 \text{ m}^{-1}$ . This law was used in determining the values of the coefficients of turbulent exchange. These were in the range from 1.0 to 11.5  $\text{cm}^2/\text{sec}$ . Figures 2; references 13: 10 Russian, 3 Western.  
[394-5303]

UDC 551.465.15

#### SOME CHARACTERISTICS OF BOTTOM DENSITY CURRENTS

Moscow OKEANOLOGIYA in Russian Vol 25, No 3, May-Jun 85  
(manuscript received 23 Sep 83, after revision 23 Jan 84) pp 420-424

ANUCHIN, V. N., BELOKOPYTOV, V. M. and GRITSENKO, V. A., Kaliningrad  
Technical Institute of Fishing Industry and Economy; Moscow Power Institute

[Abstract] Bottom density currents have a number of interesting properties, the most important of which is the propagation of these flows over very great distances without a significant change in their thickness. The authors investigated the plane flow of a denser fluid in a less dense fluid along a sloping bottom, thereby modeling the shelf zone and the continental slope. Salinity stratification is assumed. On the basis of a general system of equations of thermohydrodynamics a system of equations is derived for describing movement of the bottom flow. An analysis of the corresponding laminar flow gave distributions functionally similar to those observed experimentally and a completely inadequate "lifetime" of the bottom flow, indicating a turbulent nature of the flow of a bottom density current, with a clearly expressed anisotropy of turbulence. Vertical profiles of current velocity and density were obtained for different moments in time, as well as the distributions of turbulent stress obtained as a result of numerical solution. Experimental and computed data are compared. The negative value of turbulent stress at the upper boundary of the flow is apparently one of the main reasons for the great "lifetime" of bottom density flows. The analysis of the existence and dynamics of bottom density currents indicates that the described model, within the framework of the initial assumptions, makes it possible to describe the internal structure of bottom flows. The

laws of existence and development of bottom density currents differ substantially from the laws of development of simple shear flows or surface currents. Allowance for the propagation of bottom density currents is necessary for a proper understanding of global oceanic circulation and its modeling. Figures 3; references 12: 6 Russian, 6 Western.  
[394-5303]

UDC 551.46

#### SOUND SCATTERING BY CRUSTACEANS AND THEIR CONCENTRATIONS IN OCEAN

Moscow OKEANOLOGIYA in Russian Vol 25, No 3, May-Jun 85  
(manuscript received 5 Jul 83) pp 425-430

ANDREYEVA, I. B. and LYSAK, D. P., Acoustics Institute imeni ak.  
imeni ak. N. N. Andreyev, USSR Academy of Sciences, Moscow

[Abstract] An acoustic model of crustaceans is formulated and the possible values and frequency dependence of the backscattering coefficient of their concentrations are evaluated. The model is developed in the form of an elastic hard envelope filled with liquid. The influence of the physical parameters of the materials used in the model and its configuration are evaluated. Polar backscattering diagrams of shrimp are examined and their model description is given. The backscattering coefficients of concentrations of mesoplankton organisms and large shrimps are computed. Different formulas are derived and special graphs are constructed for organisms of different sizes. For example, the values of the backscattering coefficient  $m$  for typical concentrations of large organisms, regardless of the irradiation aspect, are many orders of magnitude greater than for concentrations of small mesoplankton organisms. Such concentrations are easily detected by the hydroacoustic method. Graphs make it possible to reckon  $m$  and other parameters of concentrations. An increase or decrease in the concentration of animals is proportional to  $m$ . Figures 6; references 9: 7 Russian, 2 Western.  
[394-5303]

UDC 551.464(265.1)

#### HIGHLY DISPERSE MINERALS IN SEDIMENTS IN NEIGHBORHOOD OF EAST PACIFIC OCEAN RISE DETERMINED FROM DRILLING DATA

Moscow OKEANOLOGIYA in Russian Vol 25, No 3, May-Jun 85  
(manuscript received 8 Feb 83, after revision 26 Oct 84) pp 465-470

GORBUNOVA, Z. N., Oceanology Institute imeni P. P. Shirshov, USSR Academy  
of Sciences, Moscow

[Abstract] Extensive materials were collected on the 8th and 14th cruises of the "Dmitriy Mendeleev" and the 24th cruise of the "Akademik Kurchatov"

which make it possible to carry out a detailed study of the composition of highly disperse minerals in the region of the East Pacific Ocean Rise. Three boreholes were studied in the neighborhood of the rise. All penetrated through the sedimentary stratum down to the basalt. These materials can be used in studying the lateral change in the composition of highly disperse minerals and also vertically over the extent of formation of the entire sedimentary stratum lying on the basalts of the oceanic crust. The principal research methods were x-ray - diffractometric and electron microscopic. Borehole 159 is situated between the zones of the Clipperton and Clarion transformed faults, 2,000 km to the west of the rise. Borehole 74 is northeast of the Marquesas Islands. Borehole 319 is situated in the Bauer depression. In the sediments of borehole 159 in the horizon above the basalt there is a predominance of iron hydroxides, goethite is not found and well-crystallized Fe-montmorillonites appear upward in the borehole, which are replaced by Al-montmorillonite with an admixture of typically terrigenous hydromicas and chlorites. In hole 74 evidence of presence of metal is most clearly expressed in the horizon above the basalt, where there is poorly crystallized goethite with amorphous material, whereas upward there is Fe-montmorillonite. The sediments of hole 319 are enriched with iron hydroxides. This hole from the Early Miocene to the Quaternary at all times was in the area of metal-bearing sediments, which was broad due to rapid spreading. There are poorly crystallized goethites in the sediments of the Upper Miocene at a depth of 30 m, and not only directly above the basalt. In the Bauer depression there is also high hydrothermal activity exerting an influence on the intensity of mineral formation. The distribution of highly disperse minerals in these holes reflects the tectonic history of the ocean. In the samples of metal-bearing sediments above the basalt there is a predominance of minerals formed under the influence of endogenous sources. With increasing distance from the spreading axis their role decreased, with the endogenous minerals being replaced by a terrigenous-volcanic complex. Figures 3; references 11: 3 Russian, 8 Western. [394-5303]

UDC 551.464.618.577.475

INFLUENCE OF CYCLONIC EDDY ON DISTRIBUTION OF BIOTIC AND OPTICAL CHARACTERISTICS IN NEIGHBORHOOD OF SAYA DE MALHA BANK (INDIAN OCEAN)

Moscow OKEANOLOGIYA in Russian Vol 25, No 3, May-Jun 85  
(manuscript received 28 Jun 83, after revision 21 Feb 84) pp 490-496

KRUPATKINA, D. K., KUZMENKO, L. V. and MANKOVSKIY, V. I., Biology of Southern Seas Institute imeni A. O. Kovalevskiy, Ukrainian Academy of Sciences, Sevastopol; Marine Hydrophysical Institute, Ukrainian Academy of Sciences, Sevastopol

[Abstract] A study was made of the spatial distribution of primary production, chlorophyll and optical characteristics of waters in the

neighborhood of Saya de Malha Bank in the Indian Ocean with a clarification of the factors determining it. The work was done on the 24th cruise of the "Akademik Vernadskiy" in August 1981. The following were investigated in a test range whose southern edge adjoined Saya de Malha Bank: primary production, concentration of chlorophyll "a," numbers and biomass of phytoplankton, its systematic and size composition, and also functional indices. Optical measurements included determination of the light attenuation index, color index of the water layer and depth of visibility of a white disk. In the layer 0-100 m samples were taken from 5-8 horizons. In the north-western part of the test range there was a cyclonic eddy (~90 x 150 miles), occupying the upper 150-m layer. Upwelling in the eddy caused a decrease in thickness of the upper isothermic layer (up to 20 m at the center of the eddy), a decrease in temperature of this layer by 1.5° in comparison with the background, and a nonuniformity in the distribution of primary production and chlorophyll "a." In the background waters the thickness of the upper quasi-homogeneous layer and its temperature considerably increased. As a result of upwelling the concentration of biogenous elements in the eddy was above the background. The eddy moved southeastward at a rate of 1-2 miles per day. The waters in the eddy and beyond its limits differed with respect to the structural indices of phytoplankton. It was concluded that the nonuniformity of biotic and optical characteristics near the bank was due to the influence of the cyclonic eddy. On the basis of the quantities of primary production and chlorophyll "a" the background waters can be defined as oligotrophic and the eddy waters as mesotrophic. The maximum primary production, chlorophyll concentration and minimum transparency values were in the mesotrophic waters. The color index in the eddy waters exceeded the background values by a factor of 3-5, the extinction index by a factor of 1.5 and the depth of visibility of a white disk, by a factor of almost 2. Figures 4; tables 2; references 21: 13 Russian, 8 Western.  
[394-5303]

UDC 577.475(262)

# SPONTANEOUS BIOLUMINESCENCE OF DINOFLAGELLATES IN VOSTOK BAY, SEA OF JAPAN

Moscow OKEANOLOGIYA in Russian Vol 25, No 3, May-Jun 85  
(manuscript received 25 Apr 83, after revision 1 Oct 84) pp 509-512

BOZIN, S. A. and FILIMONOV, V. S., Biophysics Institute, Siberian Department, USSR Academy of Sciences, Krasnoyarsk

[Abstract] Although the literature contains many data on the diurnal dynamics of phytoplankton, including dinoflagellates, and also diurnal migrations of zooplankton and diurnal changes in sea bioluminescence, there has never been a simultaneous study of the dynamics of development of phyto- and zooplankton, or as an index of the definite interrelationships between them, no author has ever used spontaneous luminescence continuously over the course of several days. Accordingly, a method has been developed and continuous measurements have been made of the multiday dynamics of spontaneous

bioluminescence of dinoflagellates in plankton samples, with an evaluation of parallel changes in the qualitative and quantitative composition of luminescent species of dinoflagellates and zooplankton. The experiment was made with plankton samples taken in the coastal zone of Vostok Bay, Sea of Japan, during the period 14-18 October 1981. The depth of the sampling point was 4 m. Samples were taken from the upper meter layer of water 6-8 times a day. Water temperature was measured in the surface 10-cm layer 4 times a day; salinity was measured once a day. On the basis of these data it is postulated that the spontaneous bioluminescence of dinoflagellates can be regarded as mechanically stimulated with an intensity of the stimulus close to the threshold value. This stimulus is the collision of dinoflagellates with zooplankton and probably with the wall of the vessel containing them when measuring spontaneous luminescence. The spontaneous bioluminescence of dinoflagellates is a good index of their numbers (the correlation coefficient for 5 days of measurements is 0.90) and does not exhibit diurnal changes. Figures 3; references 10: 3 Russian, 7 Western.  
[394-5303]

UDC 551.467

GEOLOGICAL-GEOPHYSICAL INVESTIGATIONS ON TENTH CRUISE OF SCIENTIFIC RESEARCH SHIP 'PROFESSOR SHTOKMAN'

Moscow OKEANOLOGIYA in Russian Vol 25, No 3, May-Jun 85 pp 538-540

YELNIKOV, I. N.

[Abstract] The 10th cruise of the "Professor Shtokman" lasted from 1 July to 7 October 1983. The objective was study of the deep structure of the Barents and Kara Seas, lithodynamic processes and gas-biochemical fields in the Barents Sea-White Sea region. The work was done in two stages. In the first stage (Kaliningrad-Murmansk) geological-geophysical observations were made in two test ranges in the Barents Sea. The geophysical observations included wide-angle continuous seismic profiling (WACSP), gravimetric observations and echo sounding. WACSP differs from continuous seismic profiling (CSP) in a considerably greater distance of the receiving system from the source of elastic oscillations in comparison with depth of discontinuities beneath the sea floor. About 7,000 km of profiles were run by geophysical methods and 84 geological stations were occupied. In the second stage work was done by the reflected waves method (common depth point method), accompanied by gravimetric observations and echo sounding. Work was done in the Barents and Kara Seas. A total of 4,400 km of reflected waves-common depth point profiles were run. Work was done under exceptionally good weather conditions and for the first time in the Barents Sea it was possible to do such work to 80°N and in the Kara Sea work with Seismic profiling extended to 80°E, although the direction of the profiles often had to be changed or the work terminated due to the presence

of ice fields. The work by the WACSP method was particularly interesting. The possibility of studying deep discontinuities with a complex configuration was demonstrated in cases when traditional methods do not make it possible to discriminate many details and the method will find use in the future in investigations of complex zones, such as rifts and faults.  
[394-5303]

UDC 534.232

# STUDY OF OPTICAL-ACOUSTICAL PHENOMENA AT SURFACE OF STRONGLY ABSORBING CLEARING FLUIDS

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA FIZICHESKAYA in Russian  
Vol 49, No 3, Mar 85 pp 558-563

BUNKIN, F. V., VODOP'YANOV, K. L., KULEVSKIY, L. A., LYAKHOV, G. A., MIKHALEVICH, V. G. and RODIN, A. M., General Physics Institute, USSR Academy of Sciences

[Abstract] The clearing of water by laser radiation with a wavelength  $\lambda = 2.94 \mu\text{m}$  was reported by K. L. Vodop'aynov, et al. (ZhETF, Vol 82, p 1820, 1982). For further clarification of this problem the authors studied optical-acoustic phenomena at the surface of a fluid under conditions of strong absorption and optical clearing with emphasis on detection of the characteristics of the thermal and evaporation regimes of generation of acoustic fields by laser radiation. Studies were made of different fluids containing hydroxyl groups (water, ethanol, glycerin, ethylene glycol) with different boundary conditions (free and fixed boundaries). In the case of a free boundary the laser radiation was directed downward along the normal to the fluid surface, but in the case of a rigid boundary the fluid surface was covered by a backing of transparent material. Experimental results are presented. At the present time there is no certain interpretation of the observed effects. However, it is known that the presence of hydrogen bonds in fluids containing the OH group leads to a strong shift (for water --  $250 \text{ cm}^{-1}$ ) into the region of lesser frequencies of the absorption band. Partial breaking of the hydrogen bonds under the influence of laser radiation can result in a change in the absorption spectrum of the fluid and accordingly a clearing at the laser wavelength. Also included in the study was an investigation of optical-acoustical phenomena arising during interaction between laser pulses of a picosecond duration and water. Figures 4; referenees 8: 7 Russian, 1 Western.  
[320-5303]

## AERIAL LASER SENSING OF OCEAN UPPER LAYER

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA FIZICHESKAYA in Russian  
Vol 49, No 3, Mar 85 pp 433-441

VLASOV, D. V., General Physics Institute, USSR Academy of Sciences

[Abstract] Contactless optical passive and active laser methods for sensing the upper layer of the ocean are being developed rapidly. Progress in this field is reviewed. Computers have made it possible to process enormous volumes of data collected by research ships and this has made it possible, by averaging data for weeks or months, to plot detailed maps of seasonal distributions of temperature, salinity, turbidity and other parameters. However, for many purposes it is necessary to map changes of these and other parameters on time scales of hours and days. Laser sensing makes this possible. This is illustrated in the case of search for a source of pollution in the shelf zone, especially organic matter or petroleum products. Laser sensing can be used in plotting temporal evolution of a spot of pollutants, a task which is impossible when using standard shipboard geochemical analysis methods. An airborne laser can, in the course of an hour, be used for producing a three-dimensional map for a region of 100 km<sup>2</sup>. By making repeated flights over a given region it is possible to monitor the dynamics of shelf currents, the development, evolution and dissipation of different anomalies and deviations of thermodynamic, geochemical and biological parameters of the shelf zone and upper layer of the ocean. Already known analytical laser spectroscopy methods make possible remote analysis of both the concentration of petroleum products and the identification of types of petroleum. The article discusses many other applications of laser sensing of the ocean, such as deep bathymetry, determination of the luminescence spectrum of phytoplankton as a sensitive indicator of changes in the external physical parameters of the studied region, monitoring the state of underwater pipelines, conducting a search for and rescue of persons from ships and aircraft which have experienced disasters, for monitoring pollution, biological observations of the state of algae, search for schools of fish, etc. The article describes the "Chayka" apparatus for laser sensing; a block diagram is given which is used in describing functioning of this unit. Particular attention is given to the time structure of an echo signal appearing when sensing the upper ocean layer by a short laser pulse propagating through the wave-covered surface. Figures 4; references 24: 10 Russian, 14 Western.  
[320-5303]

FORMATION OF UNDERWATER OCEANIC VOLCANOES AND ISLANDS IN RELATION TO  
LITHOSPHERIC THICKNESS AND MOVEMENTS

Moscow BYULLETen MOSKOVSKOGO OBSHCHESTVA ISPYTATELEY PRIRODY: OTDEL  
GEOLOGICHESKIY in Russian Vol 60, No 4, Jul-Aug 85  
(manuscript received 18 Oct 83) pp 24-37

GORODNITSKIY, A. M., Oceanology Institute, USSR Academy of Sciences, Moscow

[Abstract] A brief review of geological and geophysical data on oceanic volcanoes, relating their formation to the thickness and nature of movements of the lithosphere, is presented. Analysis of the height and composition of such paleovolcanoes and various island chains demonstrated that such characteristics are predicated on the pT factors of magma formation under the lithosphere. The origins of such mountains are determined by plate stresses due to tectonic forces acting at plate boundaries, membrane effects and changes in the thermal regimes of the lithosphere leading to a system of rifts. Figures 2; references 35: 23 Russian, 12 Western.  
[442-12172]

## TERRESTRIAL GEOPHYSICS

### VOLCANOES DISCOVERED WITH RADIO BEAM

Moscow TASS in English 0807 16 May 85

[Text] Kharkov May 16, TASS--Two giant volcanoes have been discovered by Soviet scientists. One of them lies beneath the hot sands of West Sahara and the other under the Antarctic ice in the area of James Ellsworth Land. The craters were spotted with the help of a radio location system installed aboard the Soviet satellites "Cosmos-1500" and "Cosmos-1602." The system was developed at the Kharkov Institute of Radio Physics and Electronics, the Academy of Sciences of the Ukraine.

"The radio beam carries a wealth of information on the structure of the earth surface to a depth of tens of meters," Anatoly Kalmykov, who is in charge of the work, told a TASS correspondent. The new method has been used with success, together with optical instruments, for long-distance sounding of the earth from space and makes possible a comprehensive study of the planet's surface. This "radioeye" with its scanning range of about five hundred kilometers is able to spot objects less than a kilometer in size. The system, operating automatically, collects, selects and codes data and transmits it back to earth in ready-to-use form.

In the opinion of specialists, the use of Kharkov-made radio locators in orbit has started a new line in the exploration of the earth's surface and the world ocean. This system has no analogues anywhere in the world for the breadth of scanning and possibilities it offers for immediately sending information, through stationary communications channels, directly to users. This system may be used not only for the exploration of the earth but also in day-to-day work in different branches of the national economy. Thus successful experiments were made to pilot ships through ice on the northern sea route and to outline the frontiers of river spring floods. In the long run it will be possible to use the new system for harvest prognosis by the condition of crops.

"The possibilities of our radio location system were highly appreciated by scientists in many countries," Anatoly Kalmykov said. "We have already received requests for information from them. We are ready to share our data with everyone because this is the way we see peaceful cooperation in space for the benefit of mankind."

FTD/SNAP

CSO: 1865/382

## NEW METHOD OF PROSPECTING FOR MINERALS

Moscow TASS in English 1252 12 May 85

[Text] Moscow May 12, TASS--A set of instruments for underground express analysis has been offered by Lvov scientists (The Soviet Republic of the Ukraine). It will help geologists and field workers to accelerate prospecting for deposits, to enhance their output.

Such equipment, moving in a small metal capsule inside the well, "fires at" surrounding rock in an endless stream of neutrons. From the reflected gamma rays sensitive indicators select only those which carry useful information. Information, processed on the surface with the help of many electronic computers, gives a detailed notion of the structure of the bowels of the earth, thickness of seams and peculiarities of their bedding.

The novelty has already proved its efficiency in oil fields of Siberia, in prospecting for phosphorite deposits in Kazakhstan.

FTD/SNAP

CSO: 1865/382

# IMPROVED TURBODRILL IN USE AT KOLA SUPERDEEP BOREHOLD

Moscow IZVESTIYA in Russian 27 Jun 85 p 1

[Text] A turbodrill whose design has been modernized by Perm specialists can operate continuously for 10 days instead of four. This information was obtained from a depth of 12 kilometers, which drillers have reached at the Kola superdeep borehole.

"The temperature at the point of drilling has reached 250 degrees," said P. Astafyev, deputy director of the Perm affiliate of the All-Union Scientific Research Institute of Drilling Technology. "In such extreme conditions, many assemblies, of the drilling rig became unreliable, particularly the reduction gear which lowers the speed of the turbine. Seals and bearings began to lose their stability and had to be changed frequently. After all, it takes half a day to raise a turbodrill from the record depth and lower it to that depth."

FTD/SNAP

CSO: 1865/407

# COMPUTER-AIDED AERIAL RADIOMETRIC SURVEYING OF SOIL MOISTURE

Moscow KRASNAYA ZVEZDA in Russian 30 Jun 85 p 2

[Article by Armand, N., doctor of technical sciences, USSR State Prize laureate]

[Abstract] The author reports on a new method and apparatus which he and his colleagues have developed for aerial radiometric surveying to determine soil moisture content. The method employs an airborne radiometer operating in tandem with an onboard computer, which converts signals into moisture-content figures. Magnetic recordings of the data are fed into a ground computer which contains information on features of the locality where the survey was made. The author reports that the new apparatus has passed field tests in a number of areas. It can be used for other environmental monitoring purposes, such as determining the content of minerals, acids, salts and alkalis in surface water and detecting changes in electrophysical properties of water.

FTD/ SNAP  
CSO: 1865/407

UDC 550.822:553.31

## NEW IDEAS RELEVANT TO DEEP STRUCTURE IN NEIGHBORHOOD OF KRIVROY ROG SUPER-DEEP HOLE

Kiev GEOLOGICHESKIY ZHURNAL in Russian Vol 45, No 4, Jul-Aug 85  
(manuscript received 22 Aug 83) pp 1-7

BURYAN, N. R., LAZARENKO, Yu. N., RESHETNYAK, V. V. and YEFIMENKO, N. G.,  
Dnepropetrovsk Division, Institute of Mineral Resources; Krivoy Rog  
Geological Prospecting Expedition, Krivoy Rog

[Abstract] New concepts have been developed on the basis of information derived from a superdeep (12 km) borehole in the village of Novoivanovka in Krivoy Rog region, in the vicinity of the Mine imeni Lenin. Integration of the geophysical analyses and gravimetric, seismic and magnetic data resulted in map construction and modeling of strata in the region. Basically, the information confirmed previous impressions that the structures of the Krivoy Rog basin consist of complex graben synclines with a monoclinial

dip to the east or west. The formation of the monoclinial structure of the Krivoy Rog region involved several stages related to systems of deep fractures. The latter show good correlation with potential fields of the region and are also supported by geological findings. Figures 3; references 7: 6 Russian, 1 Western.  
[441-12172]

UDC 550.348.436

POSSIBLE ROLE OF HYDRATION EFFECTS IN GENESIS OF HYDROGEOCHEMICAL  
INDICATORS OF IMMINENT EARTHQUAKES

Leningrad VESTNIK LENINGRADSKOGO UNIVERSITETA: GEOLOGIYA, GEOGRAFIYA  
in Russian No 14, Issue 2, Jun 85 (manuscript received 10 Dec 84) pp 75-76

LEVIN, I. G. and LEGEYDO, I. N.

[Abstract] An analysis was conducted on several earthquakes in the USSR and one in China to assess changes in the chemical composition of subsurface waters as an indicator of such imminent geologic shocks. The data showed that elastic deformations presaging earthquakes induce such chemical changes, the nature of the change depending on the type of deformation -- compression or dilatation. The changes noted prior to the earthquakes in Daghestan (Salataus, December, 1974) and in central Tajikistan (June, 1983) were marked by elevation of  $\text{Cl}^-$  and Na levels and depression of  $\text{HCO}_3^-$  and  $\text{SO}_4^{2-}$  levels. The opposite changes were seen around Beijing in the earthquake occurring in the Tien Shan in November, 1976. The differences were ascribed to compressional forces in the case of the Soviet earthquakes and a dilatation in the Chinese earthquake, which induce different types of pressure-related hydrogeochemical anomalies. Figures 2; references 6: 4 Russian, 2 Western.  
[414-12172]

UDC 550.361

CRUSTAL TEMPERATURE IN TRANSITION ZONE BETWEEN BALTIC SHIELD AND BARENTS  
SEA PLATE

Kiev GEOFIZICHESKIY ZHURNAL in Russian Vol 7, No 3, May-Jun 85  
(manuscript received 30 Jul 84) pp 58-64

GLAZNEV, V. N., SKOPENKO, G. B. and PODGORNYKH, L. V., Geology Institute,  
Kola Affiliate, USSR Academy of Sciences, Apatity

[Abstract] The thermal state of the earth's crust and upper mantle in the northeastern Baltic shield, the area of the SG-3 Kola superdeep hole, continues to be investigated. A thermal model of the crust in this region has

been constructed on the basis of the latest results from deep seismic sounding. Heat generation in crustal layers and heat flow from the mantle are estimated. An approximate equation is given for the relationship between the velocity of seismic waves and heat generation in the crust. The temperature distribution in the crust and upper mantle to a depth of 50 km is computed. It is shown that temperature in the Baltic shield crust is considerably lower than in the platform crust. This is due to an increase in the heat flow on the shelf due to an increase in the thickness of sedimentary rocks and a decrease in their heat conductivity in comparison with crystalline crustal rocks. The M discontinuity at a depth of 35-42 km under the Barents Sea plate and at 38-45 km under the Baltic shield is not an isothermic surface. Similarly the position of the Curie isotherm is unrelated to change in depth of the crust-mantle interface; in the north it is at a depth of 20 km, whereas to the south it drops to 50 km. The thermal model of the crust and upper mantle of the region is a necessary element in a comprehensive geophysical model of the transition zone from the shield to the plate. Figures 4; references 28: 27 Russian, 1 Western.  
[381-5303]

#### GEOPHYSICS INSTITUTE'S ACTIVITIES SURVEYED ON ANNIVERSARY

Tbilisi ZARYA VOSTOKA in Russian 7 Jun 85

[Abstract] On the occasion of the 50th anniversary of the Georgian Academy of Sciences' Institute of Geophysics, the authors trace the history of the institute and comment on its present activities.

The institute does basic and applied research on various questions of earth physics, atmospheric physics, and physics of sun-earth ties. It functions as the chief organization for problems of forecasting earthquakes in Georgia, and the Caucasus Regional Earthquake Forecasting Center is under its direction. The institute is also one of the country's leading organizations engaged in preventing harmful weather phenomena.

The authors mention some of the directions and results of work by the institute in these fields. Large-scale stationary and field observations have been made of seismic, gravitational, geomagnetic, geoelectric and other physical fields of the earth in the Caucasus region, for example. General and detailed seismic zoning of the region has been done, and studies of the elastic properties and internal structure of the globe have been made in support of seismologic and tidal observations. The institute is credited with achievements in studies of the physics of the ionosphere and magnetosphere. Studies of variations of cosmic rays have been advanced on a broad scale. An automated observation system has been developed for this.

ETD/SNAP

CSO: 1865/401

## PHYSICS OF ATMOSPHERE

### AIR-POLLUTION MONITORING LASER

Moscow PRAVDA in Russian 18 Jul 85 p 3

[Text] Kemerovo University's laboratory of laser probing of the atmosphere conducts regular measurements of the degree of air pollution in the city. A new method of investigating air purity and measuring dust content is now being tested here.

(A photograph showed laboratory associates G. Nasekin and V. Korchuganov with a laser unit on a tripod on a rooftop.)

FTD/SNAP

CSO: 1865/407

UDC 551.521.3

DISTRIBUTION OF BRIGHTNESS FROM POINT SOURCE OF SCATTERED LIGHT ALONG  
INCLINED PATH

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA  
in Russian Vol 21, No 6, Jun 85 (manuscript received 5 Jul 82;  
after revision 16 Apr 84) pp 603-608

DROFA, A. S. and USACHEV, A. L., Institute of Experimental Meteorology

[Abstract] In order to further define visibility factors in dealing with point light sources in a polluted atmosphere, calculations of brightness distribution of cloud-scattered light from a point source were analyzed by the Monte Carlo method of statistical modeling. The optical scheme employed corresponded to observation of a terrestrial object through a cloud cover. Light intensity distribution was measured with a sensor possessing an infinitely small aperture, positioned at the upper boundary of the cloud cover. The line of sight was maintained at selected angles of inclination ( $\theta$ ) to the zenith. Analysis of the relationships between the intensity and asymmetry of the distribution and cloud characteristics demonstrated that asymmetry may be either positive or negative. In case of an inclination angle of  $\theta \gtrsim 80^\circ$  displacement of the distribution maxima of light intensity may be on the order of several degrees above or below the line of sight. In addition, the intensity of the scattered light differs markedly from that observed along a vertical line of sight. Figures 4; references: 8 Russian.  
[422-12172]

## STATISTICAL CORRELATION BETWEEN OZONE LEVELS OVER ATLANTIC OCEAN AND METEOROLOGICAL VALUES

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA  
in Russian Vol 21, No 6, Jun 85 (manuscript received 27 Apr 83;  
after revision 19 Apr 84) pp 609-613

BAZHANOV, V. M., State Oceanographic Institute

[Abstract] A statistical study was conducted on the levels of ozone over the Atlantic Ocean in relation to certain meteorological parameters, using data obtained during the February-June, 1980 cruise of the research vessel "Ernst Krenkel" (53°N to 05°S; 0.7° and 57°W). The measurements showed that positive gradients of ozone levels prevailed from 20 to 53°N (and, possibly, even further north), with a mean gradient in that region of 0.005 cm per 1° latitude. Determinations of linear regressions between ozone levels  $X$  (cm) and the height of the tropopause ( $H_{tp}$ , km), air temperature at 29 km  $t_{29}$  (°C), and the atmospheric pressure  $p_0$  (gPa at the sea level yielded the following equations on the basis of the least squares method:  $X = -0.014H_{tp} + 0.539$ ,  $X = 0.006t_{29} + 0.678$  and  $X = 0.003p_0 - 2.750$ .

In addition, a negative correlation coefficient was obtained for the relationship between the ozone level and the concentration beryllium-7 (-0.44) and total beta-radioactivity (-0.39). Figures 1; tables 2; references 22: 19 Russian, 3 Western.  
[422-12172]

## INFLUENCE OF FOG MICROSTRUCTURE ON QUALITY OF OPTICAL IMAGE TRANSMITTED THROUGH IT

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA  
in Russian Vol 21, No 5, May 85 (manuscript received 31 Jan 83,  
after revision 10 May 83) pp 507-511

VOLNISTOVA, L. P., DROFA, A. S. and SNYKOV, V. P., Institute of Experimental Meteorology

[Abstract] Data on the optical transfer function (OTF) of fogs with different microstructures are presented. These are compared with the results of computations of the OTF carried out taking into account the microstructure of a fog measured synchronously with optical investigations. The research was carried out on a path 6 m long in the large aerosol chamber at the Institute of Experimental Meteorology. The OTF of a fog artificially formed in the chamber was determined experimentally using measurements of the

brightness profile of the image of a narrow self-luminescent line observable through a fog. The brightness of the line image was measured with a photomultiplier situated behind the focus of a receiving objective (diameter 100 mm, focal length 1,000 mm). The resolution of the light receiver was determined by a measurement slit placed in the objective focus and was 20". The brightness profile was determined by angular scanning of the line image by the photodetector field of view in the plane perpendicular to the line. The electric signal from the photomultiplier, proportional to brightness, was amplified by a logarithmic amplifier and registered on the tape of an automatic potentiometer and also on punched tape. By means of color light filters the spectral range of the light registered by the photomultiplier was limited to the band 0.55-0.7  $\mu\text{m}$ . The artificial fog in the aerosol chamber was formed either by rapid adiabatic expansion of air precompressed in the chamber or by the spraying of water with a nozzle. Fog transparency and its microstructure were measured during the experiments. A laser photoelectric aerosol counter was used in measuring the fog-droplet distribution function in the range  $0.4 \mu\text{m} < r < 15 \mu\text{m}$ . After fog formation its microstructure is transformed due to droplet evaporation due to heat release from the chamber walls and due to droplet precipitation onto the floor and walls. The time required for total disappearance of the fog was 40-60 minutes. The experimental data agreed well with computations. Actual and possible sources of error are examined. Figures 3; references: 10 Russian. [395-5303]

UDC 551.501.75:551.596.1

# EXPERIENCE IN MEASURING MEAN WIND VELOCITY PROFILE IN LOWER TROPOSPHERE BY SODAR ANEMOMETER UNDER INVERSION AND CONVECTIVE CONDITIONS

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 21, No 5, May 85 (manuscript received 18 Jan 83) pp 492-497

KALLISTRATOVA, M. A., KEDER, Y., PETENKO, I. V. and TIME, N. S.,  
Atmospheric Physics Institute, USSR Academy of Sciences

[Abstract] Specialists at the Atmospheric Physics Institute have developed a sodar anemometer (G. V. Azizyan, et al.; IZV. AN SSSR, FAO, Vol 20, No 1, pp 100-104, 1984) for measuring the horizontal component of wind velocity. It is a slant monostatic sodar for measuring the Doppler shift of the frequency of sound reflected from moving air density inhomogeneities. The sodar parabolic antenna is attached together with a sound-absorbing shaft on a framework at an angle of  $45^\circ$  to the horizon. The frame can be turned  $90^\circ$  about the vertical axis and thereby ensures successive measurement of the two wind velocity components in the horizontal plane. The acoustic channel operates in a pulsed transmitting-receiving regime with a radiated acoustic power of 6 W, a radiation frequency of 2 KHz and a duration of the sonic pulse of 100 msec. Measurements with this sodar

were made in the summer of 1981 in the steppe near Tsimlyansk during an International Expedition for Instrument Comparison. The wind velocity profile was measured on a mast to a height of 32 m with cup anemometers; the mast was at a distance of 40 m from the sodar anemometer. Also employed was a vertical sonar developed by the Czechoslovakian Hydrometeorological Institute which registered echo signal intensity on a facsimile apparatus which provides data on the spatial-temporal distribution of temperature fluctuations  $C_T^2$ . The type of atmospheric stratification can be determined from the form of the facsimile records. The combined measurements provided data on the behavior of the wind velocity profile under convective and inversion conditions. Figures 5; references 10; 7 Russian, 3 Western.  
[395-5303]

UDC 551.510.522:551.501.724

#### STRUCTURAL CHARACTERISTIC OF TEMPERATURE FIELD OVER SEA

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 21, No 5, May 85 (manuscript received 8 Sep 83) pp 485-491

KOPROV, B. M., Atmospheric Physics Institute, USSR Academy of Sciences

[Abstract] The structural function of the temperature field (the dependence of the square of the temperature difference  $T$  at two points on the distance  $r$  between points) is described by the law  $D_{TT}(r) = C_T^2 r^{2/3}$  if the distance between points  $r$  satisfies the condition  $r_k \ll r \ll L$ , where  $r_k$  and  $L$  are the internal and external scales of the turbulent flow.  $C_T^2$  is the structural characteristic of the temperature field. Measurements in the surface atmospheric layer yielded universal expressions relating  $C_T^2$  and atmospheric surface characteristics but far fewer studies have been made for the near-water layer. In this layer the fields of wind velocity, temperature and humidity have specific characteristics not typical of the near-ground layer. Density stratification and the generation of kinetic energy by buoyancy forces are determined to an equal degree by the distribution of temperature and humidity (the contribution of humidity variations to the variability of density with altitude in the near-ground layer is negligible). Aboard a ship it is very difficult to measure temperature, velocity and humidity profiles. It is only feasible to measure temperature, wind velocity and humidity at a height of about 10 m and water temperature near the surface. Regular measurements of the structural characteristic and meteorological parameters were made on the 36th cruise of the "Akademik Kurchatov" (February-March 1983) in the Baltic Sea, North Sea, Mediterranean Sea, Red Sea and Indian Ocean. Sensors were 14 m above water level. Among the instruments used was a special difference-type resistance micro-thermometer (described in some detail, with a block diagram).  $C_T^2$  was computed from the measured  $D_{TT}(r_0)$  value. Measurements were made in series with a duration of about 10 minutes and then the mean  $C_T^2$  value was

computed for time intervals from 1 to 3 hours. This made it possible to ascertain the correlation between the structural characteristic of temperature and parameters determined from standard meteorological observations. Figures 3; tables 1; references 9: 8 Russian, 1 Western. [395-5303]

UDC 551.515

ATMOSPHERIC SYNOPTIC EDDIES OVER OCEAN (DETERMINED FROM EXPERIMENTAL DATA)

Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 21, No 5, May 85 (manuscript received 21 Oct 83, after revision 23 Jan 84) pp 474-484

LAGUN, V. Ye. and ROMANOV, V. F., Arctic and Antarctic Scientific Research Institute

[Abstract] Synoptic eddies over the ocean were investigated using data from the "POLEKS-Sever-79" experiment, carried out in summer over the Norwegian Sea. The experiment lasted 3 months with a discreteness of synchronous observations of 12 months. The extent of the test range corresponded to the scales of synoptic eddies ( $3 \cdot 10^{12} \text{ m}^2$ ). Aerological sounding data were obtained at 14 coastal stations, from 2 weather ships and 2 research ships. All the main atmospheric parameters were measured from the underlying surface to 100 mbar at standard isobaric surfaces. Radiosonde data, land meteorological measurements, hydrological and satellite data were also used. The test range is characterized by a great frequency of recurrence of synoptic eddies, usually in the phase of their maximum development. It was found that atmospheric synoptic eddies differ sharply in their parameters of motion (can move arbitrarily relative to the main flow), dynamics and energetics. The main contrasts are localized in the peripheral zone of the synoptic eddy and frequently have a jumplike character. This indicates the possibility of a two-phase interpretation of the atmosphere: mean flow - synoptic eddy. Then the dynamic parameters of the synoptic eddy and the surrounding medium can be described by different dynamic equations which include common terms characterizing the forces of dynamic interaction between moving and rotating synoptic eddies and the moving masses of the surrounding medium in which the spatial vorticity scale is substantially greater than the synoptic scale. The forces determining the dynamic regime of the synoptic eddy can be interpreted as the forces of turbulent interaction between the eddy and the flow. Figures 4; references 20: 19 Russian, 1 Western. [395-5303]

INFLUENCE OF PETROLEUM POLLUTION ON OCEAN-ATMOSPHERE GAS EXCHANGE INTENSITY  
(IN EXAMPLE OF NORTH ATLANTIC)

Moscow VESTNIK MOSKOVSKOGO UNIVERSITETA, SERIYA 3: FIZIKA, ASTRONOMIYA  
in Russian Vol 26, No 3, May-Jun 85 (manuscript received 16 May 84)  
pp 71-74

ALEKSEYEV, V. V., BARANOV, P. A., KOKORIN, A. O. and SHEREMET'YEV, V. M.,  
Department of Marine Physics and Waters of Land, Moscow University

[Abstract] A surface film exerts additional diffusional resistance to gas transfer, damps waves and reduces water surface roughness. Film influence increases rapidly at wind speeds 2-6 m/s. At greater wind speeds, with intensive wave collapse, the film is collected into individual bands and its influence is small. Upon wave collapse the gas exchange rate increases sharply. Accordingly, the influence of a petroleum film essentially involves a smoothing of waves and shift of onset of a strong increase in the rate of gas exchange in the direction of greater wind speeds. This constitutes one of the strongest anthropogenic effects on oxygen exchange between the ocean and atmosphere. The article gives a specific evaluation of the influence of petroleum pollution on gas exchange intensity. Laboratory experiments determined gas transfer through the water-air interface with the presence of a hydrocarbon film on the surface under conditions of wind-wave mixing and during thermal convection. During the experiment measurements were made of the CO<sub>2</sub> concentration in water and in the air; CO<sub>2</sub> fluxes at the water-air interface and values of the gas exchange rate coefficient were obtained. Four experiments were conducted. The first and second were made with the wave generator inoperative and without wave collapse. In the absence of wave collapse the film weakened the rate of gas exchange by approximately half. Strong wave collapse greatly increased the gas exchange rate. Thermal convection also exerts an influence on gas exchange between the ocean and atmosphere, with its role being strongest during autumn-winter cooling. Convection results in an intensification of gas exchange comparable to the influence of wind-wave mixing: a hydrocarbon film reduces the gas exchange rate caused by convection by approximately half. The experimental data were used in estimating the influence of petroleum pollutants on the intensity of gas exchange in the North Atlantic, based on data for the period 1975-1980 (about 70,000 observations), supplemented by American data for 1974-1978 (about 65,000 observations). A map of the probability of North Atlantic pollution is given. As a result of petroleum films there is an average decrease in the rate of gas exchange by 2-3% (far greater in badly polluted regions). Figures 1; references 10: 9 Russian, 1 Western. [403-5303]

## STATISTICS OF INTENSIVE LIGHT BEAMS IN TURBULENT ATMOSPHERE

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA FIZICHESKAYA in Russian Vol 49, No 3, Mar 85 pp 442-449

KANDIDOV, V. P., Moscow State University imeni M. V. Lomonosov

[Abstract] The results of a statistical study of the propagation of strong laser beams in different radiation regimes in a turbulent atmosphere are presented. The adaptive focusing of light beams is examined under conditions of the joint influence of nonlinear refraction and inhomogeneities of medium parameters. This analysis is made by numerical methods in the approximation of the parabolic theory of diffraction. It was found that the joint influence of nonlinearity and inhomogeneity of the medium during the propagation of strong light beams in the atmosphere is manifested in transformation of the statistical characteristics of radiation under thermal self-effect conditions and a change in integral parameters under the influence of turbulence. Light field disturbances decrease as a result of their thermal defocusing in the case of small nonlinearity and increase simultaneously with a worsening of coherence as a result of enrichment of the spatial field spectrum with accumulation of nonlinearity to  $R_v > 40$ . Under wind refraction conditions the light beam becomes statistically anisotropic. The integral parameters of a strong light beam in the atmosphere are determined for the most part by nonlinear refraction. Adaptive beam phase control effectively compensates disturbances associated with inhomogeneity of the medium. On atmospheric paths it is the lower aberrations which predominate in the nonlinear distortions; these can be compensated by using simple phase correctors with a small number of modal control channels. Figures 4; references 18: 17 Russian, 1 Western. [320-5303]

UDC 537.876.23.029.7:551.510.5

## NEW METHODS FOR LASER SOUNDING OF ATMOSPHERE ON BASIS OF NONLINEAR EFFECTS

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA FIZICHESKAYA in Russian Vol 49, No 3, Mar 85 pp 418-427

ZUYEV, V. Ye. and KOPYTIN, Yu. D., Atmospheric Optics Institute, Siberian Department, USSR Academy of Sciences

[Abstract] The search for and development of new methods and apparatus for remote sensing on the basis of an extensive class of nonlinear and coherent effects arising when using radiations of high-power lasers is discussed. Among the progressive methods now in different stages of development are the following: remote analysis of the atomic composition of the matter in aerosols and some meteorological parameters on the basis of the characteristic

electromagnetic and acoustic radiation of plasma of low-threshold optical breakdown of the surface atmosphere; analysis of the particle-size distribution in an aqueous aerosol using the effect of nonlinear Raman scattering of radiation at the characteristic frequencies of resonance oscillations of the shape of particles excited by pulsed-periodic laser radiation; highly sensitive homodyne (heterodyne) reception of weak IR signals and gas analysis of minor atmospheric pollutants with use of the effects of nonlinear interaction between reference and reflected radiations in the laser resonator. In remote sounding no use has yet been made of the possibility of active Raman scattering spectroscopy and resonance fluorescence with multiphoton absorption, the effects of spectral automodulation in a dynamically nonlinear medium, a variant of the method of multiwavelength diagnosis of absorbing aerosol during its radiational evaporation and fragmentation and a number of other nonlinear optical phenomena. Also promising is a combination of methods for linear and nonlinear sounding for extracting multiparameter information without stipulation of a priori simplifying models of the medium. Figures 6; references 27: 24 Russian, 3 Western.  
[320-5303]

UDC 621.391.81.621.375.8

#### INTERACTION BETWEEN POWERFUL LASER RADIATION AND ATMOSPHERIC AEROSOLS

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA FIZICHESKAYA in Russian Vol 49, No 3, Mar 85 pp 450-458

GORDIN, M. P., GRACHEV, Yu. N., LOSKUTOV, V. S., SADOVNIKOV, V. P., SOKOLOV, A. V. and STRELKOV, G. M., Radio Engineering and Electronics Institute, USSR Academy of Sciences

[Abstract] The results of theoretical and experimental studies of the propagation of powerful laser beams in aerosol media carried out for the most part at the Radio Engineering and Electronics Institute are presented. Emphasis is on the interaction of an individual particle and a polydisperse system of particles with the radiation field, changes in the transparency of aerosol layers under the influence of radiation and the propagation of laser beams through the turbid atmosphere. Liquid-droplet aqueous and soot aerosols were the investigated objects. Soot was investigated because it is radically different from an aqueous aerosol in the nature of its interaction with radiation and with a sufficiently high radiation intensity the soot particles ignite. Most of the presented results were obtained with a radiation wavelength  $\lambda = 10.6 \mu\text{m}$ . The effect of laser radiation on a droplet increases the temperature and density of saturated water vapor at its surface in comparison with the temperature and density of ambient vapor. Due to diffusive or convective transfer of vapor into surrounding space there is a regular change in droplet radius with time. If the temperature within the droplet attains the temperature of boiling of water the formation and rapid growth of vapor bubbles occurs within its volume. This results in the explosive breakdown of the droplet into a great many fine droplets. In

a general case a solution of the system of equations describing the process of clearing of an aerosol is possible only by numerical methods due primarily to nonlinearity of the interaction between an individual particle and the radiation field. With this taken into account, approximate clearing models are formulated for aqueous aerosols and sooty aerosols. Some ideas are presented concerning laser beam propagation in a turbid atmosphere: thermal distortions of CO<sub>2</sub>-laser beam in aqueous aerosol being cleared; propagation of continuous beam in moving cloud medium; propagation of laser pulse in sooty aerosol being cleared. The theoretical and experimental investigations described in this article give the general picture of propagation of laser beams in aerosol media and this will make possible evaluation of the energy parameters necessary for developing improved lasers. Figures 4; references: 26 Russian. [320-5303]

UDC 535.431:621.378.3

INVESTIGATION OF NONLINEAR SPECTROSCOPIC EFFECTS IN INTERACTION BETWEEN CO<sub>2</sub>-LASER RADIATION AND ATMOSPHERIC GASES

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA FIZICHESKAYA in Russian Vol 49, No 3, Mar 85 pp 459-465

AGEYEV, B. G., GORDOV, Ye. P., PONOMAREV, Yu. N. and TVOROGOV, S. D., Atmospheric Optics Institute, Siberian Department, USSR Academy of Sciences

[Abstract] Many effects of nonlinear light absorption are known, but the theory of resonance interaction is based on the use of procedures developed in linear spectroscopy for the central part of the line contour. In order to clarify this problem, a study was made of nonlinear nonresonance light absorption when field frequency falls on the extremely distant wing of the spectral band. The experiment involved study of the dependence of absorptivity of H<sub>2</sub>O, D<sub>2</sub>O vapor on the intensity of pulsed radiation of a CO<sub>2</sub> laser at a wavelength of 10.6  $\mu$ m. The measurements were made using an optical-acoustical spectrometer, including a pulsed CO<sub>2</sub> laser, a system for registry of characteristics of the laser pulse, an optical-acoustic detector with a wide-band amplifier and a vacuum unit for preparing the gas medium to be investigated. The optical-acoustical detector with its wide-band amplifier was used in measuring the dependence of the energy absorbed in a unit volume of the investigated gas on the intensity of the laser radiation passing through this volume. The discussion of the theory and the collected experimental data explain the appearance of this effect and give its qualitative characteristics. It is possible to trace the dependence of the light absorption coefficient in the band (line) wing on the intensity of radiation. Figures 4; references: 5 Russian. [320-5303]

OBSERVATION OF OPTICAL-RADIO FREQUENCY RESONANCE IN  $H_2O$  USING WIDE-BAND RUBY LASER SPECTROSCOPY

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA FIZICHESKAYA in Russian  
Vol 49, No 3, Mar 85 pp 516-520

KOCHANOV, V. P., LOPASOV, V. P. and LUK'YANENKO, S. F., Atmospheric Optics Institute, Siberian Department, USSR Academy of Sciences

[Abstract] A study was made to ascertain the influence of intra-Doppler Stark splitting caused by a strong radio-frequency (RF) field on the absorption spectrum of breakdown optical radiation under conditions of complex resonance of optical and RF fields and the transitions corresponding to them. The investigated object was the  $H_2O$  molecule, having a constant dipole momentum  $\sim 2D$  and a complex structure of rotational levels. A wide-band VRL (ruby laser) spectrometer developed earlier (V. P. Lopasov, et al., ZhPS, Vol 33, p 50, 1980) was used in the work. The absorbing matter (water vapor) was in a small cell within a resonator, situated in the plates of a capacitor which generated a RF field with a strength up to  $30 V \cdot cm^{-1}$  and a frequency 0.3-20 MHz. Interferograms of the generation spectrum were registered on fine-grained film. Measurements were made at room temperature both for pure water vapor at a pressure  $P_{H_2O} = 10$  mm Hg and with the

addition of 170 mm Hg of nitrogen. It was possible to determine the dependence of the half-width  $\delta$  and relative depth  $I$  of the trough in the generation spectrum corresponding to the investigated absorption line on  $E_0$  (external electric field) and  $\Omega$  (variable electric field) and the relative orientation of the plane polarizations of the laser radiation and RF field. For determining the changes in the trough parameters caused by the RF field,  $\delta$  and  $I$  values were measured in its presence and in its absence for fixed  $E_0$  and  $\Omega$  with averaging of 15-20 records. An analysis was made of the qualitative picture of the phenomenon and its possible mechanisms. It was found that the main reason for the observed narrowing and broadening of the trough is complex radiooptical resonance, the resonance summation of the amplitudes of probabilities of weak optical and allowed RF transitions between Stark splitting M-sublevels. Figures 2; references 12: 10 Russian, 2 Western.  
[320-5303]

EFFECTIVENESS OF USE OF ADAPTIVE OPTICAL SYSTEMS UNDER CONDITIONS OF RADIATION  
SELF-EFFECT IN ATMOSPHERE

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA FIZICHESKAYA in Russian Vol 49,  
No 3, Mar 85 pp 536-540

KONYAYEV, P. A., LUKIN, V. P. and MIRONOV, V. L., Atmospheric Optics  
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[Abstract] Numerical modeling of coherent adaptive optical systems operating on the principal of phase conjugation of a reference wave was carried out for the purpose of evaluating their maximum effectiveness in the transmission of laser energy through the atmosphere. The degree of suppression of thermal distortions of laser beams by such systems was investigated in the case of propagation in a moving a slightly absorbing regular medium and in a randomly inhomogeneous medium. In earlier studies of this problem the emphasis was on "slow" phase-conjugate adaptive systems (a "slow" adaptive system is one for which the reaction time consists of the measurement time and phase front correction time and is comparable to and even exceeds the characteristic time of medium temperature change.) In such systems, however, there is an efficiency loss as the medium nonlinearity intensifies. Accordingly, the modeling described here is for "fast" phase-conjugate adaptive systems for evaluating their limiting effectiveness when there is suppression of the thermal distortions of laser beams. ("Fast" system adaptation means that the reaction time of the adaptive system is considerably less than the characteristic time of medium temperature change.) In contrast to slow adaptive systems, analysis of operation of a "fast" adaptive system requires solution of a nonstationary equation for temperature jointly with the wave equation. The described adaptive optical system is based on an optical feedback system. Three operating regimes of the adaptive system are examined. It is shown that a "fast" phase-conjugate adaptive system is capable of increasing (by an order of magnitude) the maximum intensity of the radiation transmitted through the atmosphere. Figures 3; references 11: 10 Russian, 1 Western.  
[320-5303]

LATITUDE MEASUREMENTS OF COSMIC RADIATION INTENSITY IN STRATOSPHERE AND  
AT SEA LEVEL ON MARINE ANTARCTIC EXPEDITIONS

Moscow SHIROTNYYE IZMERENIYA INTENSIVNOSTI KOSMICHESKOGO IZLUCHENIYA V  
STRATOSFERE I NA UROVNE MORYA V MORSKIKH ANTARKTICHESKIKH EKSPEDITSIYAKH  
in Russian 1983 (signed to press 28 Jul 83) pp 1-16

SVIRZHEVSKIY, NIKOLAY SAVVICH, Physics Institute imeni P. N. Lebedev,  
USSR Academy of Sciences (Author's summary of dissertation for award of  
academic degree of Candidate of Physical and Mathematical Sciences)

[Abstract] In this dissertation the objective was to determine the correlation coefficients  $W(R, x, t)$  for the solar activity minimum 1975-1976 on the basis of stratospheric latitude measurements; measurement of the flux of soft charged radiation and gamma radiation at sea level as a function of cutoff rigidity  $R_c$  and determination of the latitude effect for the charged and gamma radiations; checking of the geomagnetic cutoff thresholds  $R_c$ , computed using the IGRF magnetic field model; clarification of the role of the radioactive background for determining the latitude effect for low-energy particles. Chapter 1 describes the design of the instrument used in cosmic ray measurements at sea level; Chapter 2 is devoted to the processing of measurement data; Chapter 3 gives the results of latitude measurements of ionizing and gamma radiations at sea level; Chapter 4 describes latitude stratospheric measurements at the solar activity minimum 1975-1976. The sea-level latitude measurements gave the flux of charged cosmic radiation and the distribution of cosmic ray intensity as a function of  $R_c$ . The fluxes of gamma radiation in the energy ranges  $E_\gamma = 50-200$  and  $200-1000$  KeV were obtained. Barometric coefficients were obtained for the full component of cosmic rays at sea level and for gamma quanta with an energy  $200-1000$  KeV. Temperature corrections were found for muons and for the total ionizing component with transition from the equator to the polar regions. Comparison of the measurements made in the northern and southern hemispheres in the Atlantic revealed a systematic difference in the  $R_c$  values which requires introduction of a correction. References 8: 4 Russian, 4 Western.  
[372-5303]

HADRON COMPONENT OF COSMIC RADIATION AT ATMOSPHERIC DEPTH 800 g/cm<sup>2</sup> IN ENERGY RANGE 70-700 GeV

Moscow ADRONNAYA KOMPONENTA KOSMICHESKOGO IZLUCHENIYA NA GLUBINE ATMOSFERY 800 g/cm<sup>2</sup> V OBLASTI ENERGIY (70-700 GeV) in Russian 1984  
(signed to press 7 Mar 84) pp 1-20

VASIL'YEV, PETR SERGEYEVICH, Physics Institute imeni P. N. Lebedev, USSR Academy of Sciences (Author's summary of dissertation for award of academic degree of Candidate of Physical and Mathematical Sciences)

[Abstract] A spark spectrometer was developed for registry of cosmic radiation hadrons. Track instruments (wide-gap spark chambers) were used as particle detectors. This resulted in an improvement in spatial resolution by a factor of almost 10. The study of this instrument in the particle beams of the Serpukhovo accelerator made it possible to reduce the systematic errors in the measurement of cosmic radiation hadrons to a minimum. Chapter 1 covers existing methods for studying the hadron component. Chapter 2 gives the characteristics of interaction between pions and protons and spark spectrometer matter obtained using the Serpukhovo accelerator. Chapter 3 is devoted to the parameters of hadron showers in the spark spectrometer, used in studying hadron fluxes in cosmic rays. Chapter 4 presents the ratios of fluxes of pions and protons, the absolute intensities of the flux of neutrons and the total hadron flux at an elevation of 2,000 m above sea level. Chapter 5 is a discussion of the measurement data. The integral intensities of fluxes of neutrons and hadrons in the energy range  $> 240$  GeV were determined. It was found that there is a systematic increase in the  $\pi/P$  ratio of fluxes in the energy range 120-330 GeV. Figures 3; references 23: 13 Russian, 10 Western.  
[372-5303]

## ARCTIC AND ANTARCTIC RESEARCH

### 'NORTH POLE 26 AND 27' DRIFTING STATIONS

Moscow TASS in English 1452 13 May 85

[Text] Leningrad May 13 TASS--New groups of Soviet scientists have started explorations in central Arctic ice on the drifting stations "North Pole-26" and "North Pole-27." Thirty-eight polar men were brought by planes to replace their colleagues after their 12-month long wintering. The explorers are conducting observation over natural processes in the ocean and the atmosphere, transmit 12 times per day weather information necessary for forecasts on huge territories of the northern hemisphere.

At the Leningrad Institute of the Arctic and Antarctica a TASS correspondent has been told that the "North Pole-26" station, which has been functioning since May 1983, driven by winds and currents, is now making a very interesting drifting around the so-called pole of relative inaccessibility--the area which is the most distant from all continents (so far only one Soviet station, "North Pole-22" was there in the 1970's).

Last winter Arctic weather sprang many unpleasant surprises upon the Polar men. Frequent bending and cracks made them change the place of the scientific township in conditions of Polar night, strong frosts and storms.

The ice floe has been practically in one place for three months now, according to a radio message from the station.

The second Soviet station "North Pole-27" is also drifting. The scientific personnel have also been changed there. That station, which was opened two years ago, is on its way to the geographic point of the North Pole and in a year or a year and a half time it is expected to be carried to the Greenland Sea.

FTD/SNAP  
CSO: 1865/382

## OPERATIONS TO AID ICEBOUND SHIP 'SOMOV' IN ANTARCTICA

Moscow VODNYI TRANSPORT in Russian 6 Jun 85 p 4

[Excerpt] The crew and researchers of the scientific expedition ship "Mikhail Somov" are waging a heroic struggle against the elements of the Antarctic. Yu. A. Izrael, chairman of the USSR State Committee on Hydro-meteorology and Monitoring of the Natural Environment (Goskomgidromet), told a TASS correspondent about a situation that has developed in this region.

"In line with the Soviet Antarctic expedition's plan of work, the 'Mikhail Somov' arrived on March 9 in the vicinity of Russkaya Station, which is located in the Pacific sector of the Antarctic," reported Yuriy Antoniyevich. "The ship had to replace the winter contingent at this station and deliver fuel and provisions to it. On March 15, a violent storm suddenly began while cargo-handling operations were in progress. The 'Mikhail Somov' found itself blockaded by heavy ice.

"In the situation which developed, the decision was made to evacuate a large portion of the crew and researchers from the 'Mikhail Somov' and to transfer them to other vessels of the Soviet Antarctic Expedition. Helicopters evacuated 77 persons, and 53 remained on the ship. The latter were members of the crew, scientific personnel, and the pilots of an MI-8 helicopter.

"An interagency operating group was created. It is made up of high-ranking representatives of Goskomgidromet and of the ministries of the merchant fleet and civil aviation, who are under the direction of Ye. I. Tolstikov, deputy chairman of our committee and an eminent polar explorer.

"The decision has been made to organize a special expedition for the purpose of ensuring the safety of the people on board the drifting ship, rendering assistance to the 'Mikhail Somov' and subsequently leading it out of heavy ice. The icebreaker 'Vladivostok' of the Far East Shipping Line is being dispatched to the area of the drift. This expedition will be headed by A. N. Chilingarov, an experienced polar explorer. The icebreaker's departure is scheduled for June 8-10."

GOSNIIGA TEAM TO EVALUATE ICEBREAKER'S HELIPAD FOR MI-8

Moscow VECHERNYAYA MOSKVA in Russian 7 Jun 85 p 3

[Text] A group of specialists of the State Scientific Research Institute of Civil Aviation (GosNIIGA) took off from Moscow for the Far East today.

Newspapers have already reported on the courageous struggle that the crew and researchers on board the Soviet scientific expedition ship "Mikhail Somov" are waging against the elements on the Antarctic. This ship is blockaded by thick ice.

According to assessments of scientists and specialists, there is little likelihood that the vessel will escape from its prison of ice by itself in the immediate future. Everything indicates that it is in for a long drift.

The decision has been made to organize a special expedition to ensure the safety of the people on board the "Somov", to render assistance to the vessel and subsequently to lead it out of heavy ice. The icebreaker "Vladivostok" is being dispatched to the area in which it is drifting.

This icebreaker has a helicopter pad from which MI-8 crews will make shuttle flights to the icebound ship. The Moscow specialists have the task of inspecting this helipad, making test flights from it and drawing conclusions about the possibility of using it. After all, it is rated for lighter types of helicopters.

The group of GosNIIGA specialists from Moscow is under the direction of P. Volovik, head of the institute's heavy-helicopter sector. He departed together with G. Provalov, a test-pilot first class, his colleague N. Seliverstov, and flight engineer M. Shayevskiy.

FTD/SNAP

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## MI-8 HELICOPTER SPECIALLY EQUIPPED FOR ANTARCTIC MISSION

Leningrad LENINGRADSKAYA PRAVDA in Russian 9 Jun 85 p 3

[Text] Aviators of our country have carried out a unique transport operation. A special MI-8 helicopter has been delivered from Moscow's Domodedovo Airport to Vladivostok. On June 8, a powerful AN-22 airplane with the helicopter on board landed at an airport of the city on the Pacific Ocean. The helicopter is intended for rendering assistance to the crew of the scientific expedition ship "Mikhail Somov", which has become icebound off the Antarctic coast.

A TASS correspondent asked B. Khimich, head of the Arctic and Antarctic Marine Administration of the State Committee on Hydrometeorology and Monitoring of the Natural Environment, to comment on this event.

"The aircraft that has been delivered to Vladivostok is somewhat unconventional," said Boris Pavlovich. "Its navigational system is specially designed for work at the South Pole, where the effect of the Earth's magnetic field differs sharply from the ordinary, as is known.

"It would have taken at least a month to re-equip a standard MI-8 helicopter here. It would have taken the 'Antarctic' variant of the aircraft approximately a week to fly on its own all the way from Moscow. These options did not satisfy us at all under the existing conditions.

"We then turned for assistance to aviators, who did an excellent job, it must be noted. The powerful aircraft was delivered with its crew and specialists to the eastern USSR's main seaport in less than 24 hours.

"Following a brief period of preparation, the special MI-8 helicopter will be taken on board the icebreaker 'Vladivostok', which will head for the Antarctic."

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## SP-26 ARCTIC STATION'S ACTIVITIES AND MOVEMENTS

Moscow VODNYY TRANSPORT in Russian 27 Jun 85 p 3

Article by N. Blinov, Candidate of Geographic Sciences, head of station "SP-26"

[Excerpt] The two "Severnny polyus" drifting stations, "SP-26" and "SP-27", are operating simultaneously in the Central Polar Basin. A large contingent of scientists and specialists of the Arctic and Antarctic Scientific Research Institute is serving a long scientific tour of duty. They are studying natural processes and phenomena occurring in an area of the Arctic Ocean that is difficult to reach.

During the month of May, the ice field moved chiefly toward the west. The length of the drift of "SP-26" was about 200 kilometers in a straight line. We have crossed the 82nd parallel. We are conducting comprehensive aerometeorological, actinometric, hydrologic and geophysical observations, and we are studying features of interaction between the ocean and the atmosphere.

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DIATOMS IN COASTAL ICE SAMPLES OF EASTERN ANTARCTIC

Leningrad VESTNIK LENINGRADSKOGO UNIVERSITETA: GEOLOGIYA, GEOGRAFIYA  
in Russian No 14, Issue 2, Jun 85 (manuscript received 10 Nov 84) pp 90-93

NIKOLAYEV, V. A. and DMITRASH, Zh. A.

[Abstract] In late (autumn) 1978 samples of ice were collected from several coastal regions in the Eastern Antarctic for microscopic examination for diatoms. The summarized data showed extensive variation in the species and number of algal cells per 1 cm<sup>2</sup> of ice in the Davis, Somov and Cosmonauts Seas, reflecting regional differences in the history of ice formation and in the structure and function of ice ecosystems. For the given specimens the number of species ranged from 11 to 54, with counts covering a range of 7 to 575 cells/cm<sup>2</sup>. Tables 1; references 9: 7 Russian, 2 Western.  
[414-12172]

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